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Description

Background of the Invention:

Field of the Invention:

This invention relates to a gamma correction device for an image sensing device or the like.

Description of the Related Art:

Heretofore, to correct the non-linearity of the light emission characteristic of the luminescent materlal of a TV Braun tube, gamma correction has been made beforehand by an image sensing device, for example, on the basis of a gamma correction characteristic such as $y = x^{\gamma}$ and $\gamma = 0.4$ to 0.5 as shown in Fig. 1.

However, in the above-stated example of the conventional arrangement, the gamma correction characteristic is always fixed. Therefore, in the event of a very bright object, for example, the image of the object cannot be fully reproduced on the Braun tube and the arrangement tends to give a blank white part.

To solve this problem, there has been proposed a method of making white compressing correction as indicated with a broken line in Fig. 1. However, this method merely prevents bright image parts from becoming blank. According to this method, dark image parts or intermediate signal levels are apt to have an insufficient tone depending on the kind of the object. In cases where sunny and shady places commingle under sunlight within one and the same still picture in particular, both black and white (dark and bright) parts become blank to give a picture which is not adequately appreciable by the human eye.

Summary of the Invention:

This invention is directed to the solution of the above-stated problems of the prior art. It is therefore an object of the invention to provide a gamma correction device which excels in tone reproducibility.

This object is achieved by a gamma correction device as claimed in claim 1.

The above and other objects and features of the invention will become apparent from the following detailed description of embodiments thereof taken in conjunction with the accompanying drawings.

Brief Description of Drawings:

Fig. 1 is a graph showing the conventional gamma correction characteristic. Fig. 2 is a block diagram showing the arrangement of a first embodiment of this invention. Fig. 3 is a conceptual representation of the video signal level-range classification and video signal regions of the first embodiment. Fig. 4 shows the contents of a gain control data ROM of the first embodiment. Fig. 5 shows a relation obtained between a video signal and a region computing time of the first embodiment. Fig. 6 is a block diagram showing the arrangement of a second embodiment of the invention. Fig. 7 is a block diagram showing the arrangement of a third embodiment of the invention. Fig. 8 is a block diagram showing a fourth embodiment of the invention. Fig. 9 is a conceptual representation of a relation obtained by the same embodiment between a video signal and its level ranges. Fig. 10 is a circuit diagram showing the level range classifying circuit of the same embodiment. Fig. 11 shows the contents of the gain control data ROM of the same embodiment. Fig. 12 shows a relation obtained by the same embodiment between a video signal and an average value detecting and ROM reading time. Fig. 13 is a block diagram showing a fifth embodiment of the invention. Fig. 14 is a block diagram showing a sixth embodiment.

Detailed Description of the Preferred Embodiments:

Embodiments of the invention are described as follows:

Fig. 2 shows in a block diagram a gamma correction device arranged according to this invention as a first embodiment thereof. Referring to Fig. 2, the illustration includes an image sensing device 1. A gain control circuit 2 is arranged to vary the degree of gain according to voltage. Attenuation control circuits 3, 4 and 5 are arranged to vary, according to the voltage, the attenuation degree of signals of given level ranges. There are provided reference power sources 6 to 9. The power sources 6 to 9 produce voltages Vr1 to Vr4 as reference signal levels. The device further comprises comparison circuits 10 to 13; level trigger counters 14 to 17; and ROMs 18 to 21 for gain control data.

With the first embodiment arranged as described above, a video signal supplied from the image sensing device 1 is compared by the comparison circuits 10 to 13 with the voltages Vr1 to Vr4 output from the reference power sources 6 to 9 as a plurality of reference signal levels. The concept of this comparison is as shown in Fig. 3. Each of the comparison circuits 10 to 13 produces a level signal at a high (H) level when the level of the input video signal exceeds the voltage. Through this process, the input video signal is divided into different level ranges a1 to a5. The level trigger counters 14 to 17 respectively count the high level signals for the level ranges a1 to a4 in a level triggering manner. Then, regions (integrating time values) A1 to A4 of these level ranges a1 to a4 are computed by the count numbers thus obtained. The gain control data ROMs 18 to 21 produce voltages for gain control according to the regions A1 to A4.

The gain control circuit 2 and the attenuation control circuits 3 to 5 jointly form a gamma correction control circuit. Fig. 4 shows by way of example the

contents of the gain control data ROMs. The gain control circuit 2 which controls the video signal gain of the overall level range is controlled by the output of the data ROM 18 as represented by G1-A1 data in Fig. 3. The attenuation degree (negative gain) of the video signal within the level range a2 is controlled by the attenuation control circuit 5 according to the output of the data ROM 19, as indicated by L1-A2 data in Fig. 4. The attenuation degree of the video signal within the level range a3 is controlled by the attenuation control circuit 4 according to the output of the data ROM 20, as indicated by L2-A3 data in Fig. 4. Further, the attenuation degree of the video signal within the level range a4 and above is controlled by the attenuation control circuit 3 according to the output of the data ROM 21, as indicated by L3-A4 data in Fig. 4. Through this process, the gamma correction characteristic is eventually controlled including a white compression correcting action on the video signal.

Further, the embodiment is arranged to allow the video signal of the level range a1 to pass through the attenuation control circuit 5 without attenuation.

The above-stated arrangement necessitates the embodiment to have a period of time for computing the region according to the level range of the video signal. Therefore, the gamma correction cannot be carried out in real time. In view of this, the arrangement of this embodiment can be advantageously applied to an electronic still video camera or the like that is arranged to be used for obtaining a still picture. In that instance, a video signal to be used for computing the region is read out beforehand from the image sensing device 1 during a period of time between time points t1 and t2 as shown in Fig. 5. After that, the region computing operation is performed during a period of time between time points t1 and t3. The gamma correction control is carried out over a video signal read out during a period between time points t4 and t5 according to the result of the region computing operation.

Fig. 6 shows in a block diagram a second embodiment of the invention. The illustration includes an analog-to-digital (hereinafter referred to as A/D) converter 31; a field or frame memory 32; a digital-to-analog (hereinafter referred to as D/A) converter 33; and elements 34 to 37 which are arranged to perform the same functions as those of the corresponding elements shown in Fig. 2.

In the second embodiment, a video signal read out from the image sensing device 1 is adequately gamma-corrected through a level range classifying means 35, a region computing means 36, a gain control data ROM 37 and a gamma correction control circuit 34 in the same manner as in the case of the first embodiment. The second embodiment, however, differs from the first embodiment in that: The video signal is digitized by the A/D converter 31. The digital signal thus obtained is stored in the field or frame memory 32. Meanwhile, the region is computed and apposite gamma correction data is read out from the gain control data ROM 37. The digital signal is converted back to an analog signal by the D/A converter 33. After that, the gamma correction is adequately carried out by the gamma correction control circuit 34.

Fig. 7 shows in a block diagram the arrangement of a third embodiment of the invention. In the case of the third embodiment, the video-signal-level-range classifying action is arranged to be performed on a digital signal obtained by digitizing the video signal by an A/D converter 31. A gamma correction control circuit 41, a level range classifying means 42, a region computing means 43 and a gain control data ROM 44 are arranged to perform their actions also on the digital signal in carrying out the gamma correction control. The process on the video signal in the form of a digital signal can be easily accomplished in accordance with the arrangement of a known digital signal processing circuit and, therefore, the details of the process are omitted from description.

In each of the embodiments described, the gamma correction control is accomplished by the combined use of circuits which are arranged to control the gain or attenuation of the video signal according to the regions computed. However, this invention is not limited to that arrangement. The arrangement may be changed and the gamma correction control may be differently carried out, for example, in the following manner: Gamma correction characteristics which are categorically patternized to correspond to the above-stated regions are arranged beforehand and stored in a memory. An applicable categorical pattern is determined according to the value of each region of the input video signal. Then, the gamma correction control can be accomplished by reading out the applicable categorical pattern.

As described in the foregoing, each of the embodiments described is arranged to divide or classify the video signal obtained from the image sensing device into a plurality of signal level ranges; to compute the value of the region of the signal within each of the divided level ranges; and to control the gamma correction characteristic according to the values of the regions thus obtained. This arrangement enables the embodiment to make apposite gamma correction according to the brightness contrast of the image of the object. The arrangement thus effectively reduces the possibility of having white or black blank parts to give an image tone which is close to the luminosity factor of the human eye.

Fig. 8 shows in a block diagram a gamma correction device which is arranged also according to this invention as a fourth embodiment thereof. The illustration includes an image sensing device 51; a gain control circuit 52 which is arranged to vary the degree of signal gain according to voltage; attenuation control circuits 53, 54 and 55 each of which is arranged to

vary the degree of signal attenuation within a given level range; reference power sources 56, 57 and 58; and voltages Vr1, Vr2 and Vr3 which are produced from these power sources. A clipping circuit 60 is arranged to clip a video signal portion above the voltage Vr1. A slice circuit 61 is arranged to take out a video signal portion within a voltage range between the voltages Vr1 and Vr2. Another slice circuit 62 is arranged to take out a video signal portion within a voltage range between the voltages Vr2 and Vr3. Another clipping circuit 63 is arranged to clip a video signal portion below the voltage Vr3.

The fourth embodiment further comprises low-pass filters (LPFs) 64 to 67; and gain control data ROMs 68 to 71.

In the arrangement described above, a video signal output from the image sensing device 51 is classified and divided by the clipping circuits 60 and 63 and the slice circuits 61 and 62 into different level ranges a1 to a4 according to the voltages Vr1, Vr2 and Vr3 output from the reference power sources 56, 57 and 58 as conceptually shown in Fig. 9. This clipping circuits 60 and 63 and the slice circuits 61 and 62 can be simply arranged as shown in Fig. 10. Referring to Fig. 10, the illustration includes resistors 75 to 78 and 86 to 90; diodes 79 to 84; PNP transistors 91, 92 and 93; and NPN transistors 94, 95 and 96. An input video signal which passes through the resistor 78 comes to the diode 84. A part of the video signal larger than the voltage Vr1 applied to the base of the transistor 96 is clipped off by the diode 84. Only a signal part within the level range a1 is allowed to be output from a terminal SA1. A signal passing through the resistor 77 has its part which is smaller than the voltage Vr1 applied to the base of the transistor 93 clipped off by the diode 82. Another signal part which is larger than the voltage Vr2 applied to the base of the transistor 95 is clipped off by the diode 83. As a result, a signal part which is between the voltages Vr1 and Vr2 is allowed to be output from a terminal SA2 in a sliced state. From a terminal SA3 is output a signal which is likewise obtained by slicing the input video signal part of a level between the voltages Vr2 and Vr3. Another signal obtained by slicing the input video signal part not exceeding the voltages Vr3 is output from a terminal SA4.

The video signal is thus divided into the level ranges a1 to a4. The signals thus obtained are averaged through LPFs 64 to 67 to obtain the average values of the signals within the level ranges respectively. Then, in accordance with these average values of signals within the level ranges a1 to a4, voltage signals which are to be used for gain control are read out from the gain control data ROMs 68 to 71 and are supplied to the above-stated circuits 52 to 55.

The gain control circuit 52 and the attenuation control circuits 53, 54 and 55 form a gamma correction control circuit. Fig. 11 shows by way of example the contents of the gain control data ROMs 68 to 71. The gain of the video signals of all the level ranges shown in Fig. 9 is controlled by the gain control circuit 52 with the output of the data ROM 68 as indicated by G1-A1 data in Fig. 11. The attenuation degree (negative gain) of the video signal within the level range a2 is controlled by the attenuation control circuit 55 with the output of the data ROM 69 as indicated by L1-A2 data in Fig. 11. The attenuation degree of the video signal within the level range a3 is controlled by the attenuation control circuit 54 with the output of the data ROM 70 as indicated by L2-A3 in Fig. 11. The gain of the video signal within the level range a4 is controlled by the attenuation control circuit 53 with the output of the data ROM 71 as indicated by L3-A4 data in Fig. 11. As a result, the gamma correction characteristic is controlled including the white compressing correction of the video signal.

Further, the signal within the level range a1 is arranged to pass without attenuation through the attenuation control circuit 55.

This embodiment, as described in the foregoing, requires time for detecting the average values of the video signal obtained within the level ranges and for reading out the gain control data on the basis of the results of detection. Therefore, the gamma correction cannot be accomplished in real time. In view of this, the effect of this invention is advantageously attainable with the arrangement of this embodiment applied to an electronic still camera or the like. In that instance, for detecting the average value, a one-field or -frame amount of the video signal is read out beforehand from the image sensing device 1 during a period between time points t1 and t2 as shown in Fig. 12. The average value of this amount of signal is detected during a period between time points t1 and t3. Then, a degree of gamma correction control obtained as a result of this is applied to the video signal read out during a period between time points t4 and t5 as shown in Fig. 12.

The same operation can be accomplished with the LPFs 64 to 67 replaced with integrating circuits.

Fig. 13 shows in a block diagram a fifth embodiment of the invention. The illustration includes an A/D converter 101; a field or frame memory 102; a D/A converter 103; and other elements 104 to 107 which are arranged to function in the same manner as the blocks indicated by broken lines in Fig. 8.

The fifth embodiment is arranged to make gamma correction on a video signal read out from an image sensing device 51 through a level range classifying means 105, an average value detecting means 106, a gain control data ROM 107 and a gamma correction control circuit 104 in the same manner as in the fourth embodiment. However, in the case of the fifth embodiment, the video signal is digitized, at the same time, by the A/D converter 101 and the digitized signal is stored in the field or frame memory 102.

Meanwhile, the average value of the signal is detected by the average value detecting means 106; and apposite gamma correction data is read out from a gain control data ROM 107. After that, the digital signal is converted back into an analog signal by the D/A converter 103 and then the gamma correction is appositely carried out through the gamma correction control circuit 104.

Fig. 14 shows in a block diagram a sixth embodiment of the invention. This embodiment is arranged to perform the level range classifying action on a signal which has been digitized through an A/D converter 101. A gamma correction control circuit 108, a level range classifying means 109, an average value detecting means 110 and a gain control data ROM 111 are arranged to perform their actions on the digital signal before conversion back to an analog signal. The digital signal processing operation can be easily accomplished in accordance with the arrangement of a known digital signal processing circuit. Therefore, the details of it are omitted from description.

In each of the embodiments described, the gamma correction control is performed by a combination of circuits which are arranged to control the signal gain or attenuation in accordance with the average value obtained for each of the level ranges. However, the invention is not limited to this arrangement. For example, the arrangement may be changed as follows: Gamma correction characteristic data corresponding to the categorical patterns of the average values of the level ranges are stored in a memory; the categorical pattern of the average value of the input video signal is determined for each level range; and the gamma correction is controlled by reading out from the memory the gamma correction characteristic data which corresponds to the pattern. This method is advantageous in a case where gamma correction control is to be performed on a digital signal.

In accordance with the invented arrangement which has been described in the foregoing, the levels of the video signal obtained from the image sensing device are classified into a plurality of level ranges according to predetermined signal level values; the average or integrated value of the video signal obtained from within each of the level ranges is detected; and the gamma correction characteristic is controlled on the basis of the results of detection. This arrangement enables each of embodiments to make gamma correction appositely to the brightness contrast of the image sensing object. Therefore, the invented arrangement gives an image with an adequate tone close to the luminosity factor of the human eye.

Claims

1. A gamma correction device comprising:
   a) gamma correcting means **(34; 41; 104; 108)** for gamma-correcting an input video signal and for outputting a gamma-corrected video-signal; and
   b) control means **(37; 44; 107; 111)** for controlling a gamma correction characteristic of said gamma correcting means,
   characterized in that
   c) classifying means **(35; 42; 105; 109)** are provided for classifying said input video signal into a plurality of level ranges **(a1 to a4)** according to a plurality of signal levels to thereby obtain a distribution of brightness; and that
   d) said control means **(37; 44; 107; 111)** controls said gamma correction characteristic according to said distribution of brightness.

2. A gamma correction device according to claim 1, **characterized by** computing means **(36; 43)** for determining said distribution of brightness by computing the respective signal ratios of said input video signal within each of said plurality of level ranges obtained by said classifying means **(35; 42; 105; 109)**.

3. A gamma correction device according to claim 2, further **characterized by** control data holding means **(18 to 21)** arranged to output a gain correction characteristic corresponding to said distribution of brightness determined by said computing means **(36; 43)**, said control means **(37; 44; 107; 111)** controlling said gamma characteristic according to said gain correction characteristic output from said control data holding means.

4. A gamma correction device according to claims 1 or 3, **characterized in that** said classifying means **(35; 42; 105; 109)** includes a plurality of comparison circuits **(10 to 13)** which are arranged to compare the level of said input video signal with a plurality of reference signal levels **(Vr1 to Vr4)**.

5. A gamma correction device according to claims 1 or 3 **characterized in that** said computing means **(36; 43)** includes a plurality of level trigger counters **(14 to 17)**.

6. A gamma correction device according to claim 1, further **characterized by** detecting means **(106; 110)** for detecting an average value or integrated value of said video signal within each of said plurality of level ranges **(a1 to a4)** obtained by said classifying means **(35; 42; 105; 109)**, wherein said control means **(37; 44; 107; 111)** controls said gamma correction characteristic according to the average or integrated value of said input video signal detected by said detecting means for each of said plurality of level ranges.

7. A gamma correction device according to claims 1, 3 or 6 **characterized in that** said control means **(37; 44; 107; 111)** is arranged to control separately from each other gains of signals of said plurality of level ranges **(a1 to a4)**.

8. A gamma correction device according to claim 6, further **characterized by** control data holding means **(68 to 71)** arranged to output a gain correction characteristic according to the average value or integrated value detected by said detecting means **(106; 110)** and corresponding to said distribution of brightness of said input video signal, said control means **(37; 44; 107; 111)** control means controlling said gamma characteristic according to said gain correction characteristic output from said control data holding means.

9. A gamma correction device according to claims 1, 3, 6 or 8, **characterized in that** said gamma correcting means **(34; 41; 104; 108)** includes a gain control circuit **(2; 52)** arranged to perform gain control in a predetermined manner over said input video signal and a plurality of attenuation control circuits **(3 to 5; 53 to 55)** arranged to perform attenuation control in a predetermined manner respectively over an output of said gain control circuit.

10. A gamma correction device according to claims 3 or 8, **characterized in that** said control data holding means **(18 to 21; 68 to 71)** includes a plurality of memory means for holding correction data for said plurality of level ranges **(a1 to a4)** respectively.

11. A gamma correction device according to claims 6 or 8, **characterized in that** said classifying means **(35; 42; 105; 109)** includes clipping and slice circuits **(60 to 63)** arranged to clip and slice said input video signal with ranges according to a plurality of reference signal levels **(Vr1 to Vr3)**.

12. A gamma correction device according to claim 4, 8 or 11, **characterized in that** said classifying means **(35; 42; 105; 109)** includes reference signal generating means having a plurality of power sources **(6 to 9; 56 to 58)** arranged in series with each other.

13. A gamma correction device according to claim 6 or 8, **characterized in that** said detecting means **(106; 110)** includes a plurality of filter means **(64 to 67)**.

14. A gamma correction device according to claim 6 or 8, **characterized in that** said detecting means **(106; 110)** includes a plurality of integrating circuits.

15. A gamma correction device according to any of the preceding claims, **characterized in that** said video signal is supplied from an image sensor **(1; 51)**.

16. A gamma correction device according to any of the preceding claims, **characterized in that** said gamma correction is performed over a digitized video signal.

17. A gamma correction device according to any of the preceding claims, **characterized in that** said input video signal is a digital signal.

18. A gamma correction device according to any of the preceding claims, **characterized in that** said video signal supplied to said classifying means is a digital signal.

Patentansprüche

1. Einrichtung zur Gammakorrektur mit
   a) einer Gammakorrektureinrichtung (34; 41; 104; 108) zur Gammakorrektur eines Eingangs-Videosignals und zur Ausgabe eines gammakorrigierten Videosignals; und
   b) einer Steuereinrichtung (37; 44; 107; 111) zur Steuerung einer Gammakorrektur-Charakteristik der Gammakorrektureinrichtung;
   dadurch gekennzeichnet, daß
   c) eine Klassifizierungseinrichtung (35; 42; 105; 109) zur Klassifizierung des Eingangs-Videosignals in eine Vielzahl von Pegelbereichen (a1 bis a4) entsprechend einer Vielzahl von Signalpegeln, um dadurch eine Helligkeitsverteilung zu erhalten, vorgesehen ist, und daß
   d) die Steuereinrichtung (37; 44; 107; 109) die Gammakorrektur-Charakteristik entsprechend der Helligkeitsverteilung steuert.

2. Einrichtung zur Gammakorrektur nach Anspruch 1, gekennzeichnet durch eine Berechnungseinrichtung zur Bestimmung der Helligkeitsverteilung durch Berechnung der entsprechenden Signalverhältnisse des Eingangs-Videosignals innerhalb jedes der besagten Vielzahl von Pegelbereiche, die durch die Klassifizierungseinrichtungen (35; 42; 105; 109) erhalten wurden.

3. Einrichtung zur Gammakorrektur nach Anspruch 2, zudem gekennzeichnet durch eine steuerdatenhalteeinrichtung (18 bis 21), die zur Ausgabe einer Verstärkungskorrektur-Charakteristik entsprechend der durch die Berechnungs-

einrichtung (36; 43) bestimmten Helligkeitsverteilung vorgesehen ist, wobei die Steuereinrichtung (37; 44; 107; 111) die Gammacharakteristik entsprechend der durch die Steuerdatenhalteeinrichtung ausgegebenen Verstärkungskorrektur-Charakteristik steuert.

4. Einrichtung zur Gammakorrektur nach Anspruch 1 oder 3, dadurch gekennzeichnet, daß die Klassifizierungseinrichtung (35; 42; 105; 109), eine Vielzahl von Vergleichsschaltungen (10 bis 13) umfaßt, die zum Vergleich der Pegel des Eingangs-Videosignals mit einer Vielzahl von Bezugs-Signalpegeln (Vr1 bis Vr4) vorgesehen ist.

5. Einrichtung zur Gammakorrektur nach Anspruch 1 oder 3, dadurch gekennzeichnet, daß die Berechnungseinrichtung (36; 43) eine Vielzahl von Pegeltriggerzählern (14 bis 17) aufweist.

6. Einrichtung zur Gammakorrektur nach Anspruch 1, zudem gekennzeichnet durch eine Erfassungseinrichtung (106; 110) zum Erfassen eines Mittelwerts oder Integralwerts des Videosignals innerhalb jedes der durch die Klassifizierungseinrichtung (35; 42; 105; 109) erhaltenen Vielzahl von Pegelbereichen (a1 bis a4), wobei die Steuereinrichtung (37; 44; 107; 111) die Gammakorrektur-Charakteristik entsprechend durch die Erfassungseinrichtung für jeden der Vielzahl von Pegelbereichen erfaßten Mittel- oder Integralwert des Eingangs-Videosignals steuert.

7. Einrichtung zur Gammakorrektur nach einem der Ansprüche 1, 3 oder 6, dadurch gekennzeichnet, daß die Steuereinrichtung (37; 44; 107; 111) zur voneinander separaten Steuerung der Verstärkung von Signalen der Vielzahl von Pegelbereichen (a1 bis a4) vorgesehen ist.

8. Einrichtung zur Gammakorrektur nach Anspruch 6, zudem gekennzeichnet durch eine Steuerdatenhalteeinrichtung (68 bis 71), die zur Ausgabe einer Verstärkungskorrektur-Charakteristik entsprechend dem durch die Berechnungseinrichtung (106; 110) erfassten Mittelwert oder Integralwert und entsprechend der Helligkeitsverteilung des Eingangsvideosignals vorgesehen ist, wobei die Steuereinrichtung (37; 44; 107; 111) die Gammacharakteristik entsprechend der durch die Steuerdatenhalteeinrichtung ausgegebenen Verstärkungskorrektur-Charakteristik steuert.

9. Einrichtung zur Gammakorrektur nach einem der Ansprüche 1, 3, 6 oder 8, dadurch gekennzeichnet, daß die Gammakorrektureinrichtung (34; 41; 104; 108) eine Verstärkungssteuerschaltung (2; 52), die zur Durchführung einer Verstärkungssteuerung in einer vorbestimmten Art und Weise hinsichtlich des Eingangs-Videosignals vorgesehen ist, und eine Vielzahl von Dämpfungssteuerschaltungen (3 bis 5, 53 bis 55) aufweist, die zur Durchführung einer Dämpfungssteuerung in einer vorbestimmten Weise hinsichtlich eines Ausgangs der Verstärkungssteuerschaltung vorgesehen sind.

10. Einrichtung zur Gammakorrektur nach Anspruch 3 oder 8,dadurch gekennzeichnet, daß die Steuerdatenhalteeinrichtung (18 bis 21; 68 bis 71) eine Vielzahl von Speichereinrichtungen zum Halten von Korrekturdaten für die Vielzahl von Pegelbereiche (a1 bis a4) aufweist.

11. Einrichtung zur Gammakorrektur nach Anspruch 6 oder 8, dadurch gekennzeichnet, daß die Klassifizierungseinrichtung (35; 42; 105; 109) Begrenzer- und Ausschnittsschaltungen (60 bis 63) aufweist, die zum Begrenzen und Ausschneiden des Eingangs-Videosignals in eine Vielzahl von Bezugssignalpegeln (Vr1 bis Vr3) entsprechende Bereiche vorgesehen sind.

12. Einrichtung zur Gammakorrektur nach Anspruch 4, 8 oder 11, dadurch gekennzeichnet, daß die Klassifizierungseinrichtung (35; 42; 105; 109) eine Bezugssignalerzeugungseinrichtung umfaßt, die eine Vielzahl von in Reihe geschalteten Spannungsquellen (6 bis 9; 56 bis 58) aufweist.

13. Einrichtung zur Gammakorrektur nach Anspruch 6 oder 8, dadurch gekennzeichnet, daß die Erfassungseinrichtung (106; 110) eine Vielzahl von Filtereinrichtungen (64 bis 67) aufweist.

14. Einrichtung zur Gammakorrektur nach Anspruch 6 oder 8, dadurch gekennzeicht, daß die Erfassungseinrichtung (106; 110) eine Vielzahl von Integrierschaltungen aufweist.

15. Einrichtung zur Gammakorrektur nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß das Videosignal von einem Bildsensor (1, 51) zugeführt wird.

16. Einrichtung zur Gammakorrektur nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Gammakorrektur an einem digitalisierten Videosignal durchgeführt wird.

17. Einrichtung zur Gammakorrektur nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß das Eingangs-Videosignal ein digitales Signal ist.

18. Einrichtung zur Gammakorrektur nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß das der Klassifizierungseinrichtung zugeführte Videosignal ein digitales Signal ist.

Revendications

1. Dispositif de correction de gamma comprenant :
   a) un moyen de correction de gamma (34; 41; 104; 108) pour corriger en gamma un signal vidéo d'entrée et pour sortir un signal vidéo corrigé en gamma; et
   b) un moyen de commande (37; 44; 107; 111) pour commander une caractéristique de correction de gamma dudit moyen de correction de gamma,
   caractérisé en ce que :
   c) des moyens de classification (35; 42; 105; 109) sont fournis pour classer ledit signal vidéo d'entrée en une multitude de gammes de niveau (a1 à a4) en fonction d'une multitude de niveaux du signal de façon à obtenir ainsi une distribution de la luminance; et en ce que
   d) ledit moyen de commande (37; 44; 107; 111) commande ladite caractéristique de correction de gamma en fonction de ladite distribution de la luminance.

2. Dispositif de correction de gamma selon la revendication 1, caractérisé par un moyen de calcul (36; 43) pour déterminer ladite distribution de la luminance en calculant les rapports de signal respectifs dudit signal vidéo d'entrée dans chacune de ladite multitude de gammes de niveau obtenues par lesdits moyens de classification (35; 42; 105; 109).

3. Dispositif de correction de gamma selon la revendication 2, caractérisé en outre par un moyen de maintien de données de commande (18 à 21) agencé de manière à sortir une caractéristique de correction du gain qui correspond à ladite distribution de la luminance déterminée par ledit moyen de calcul (36; 43), ledit moyen de commande (37; 44; 107; 111) commandant ladite caractéristique de gamma en fonction de ladite correction du gain sortie dudit moyen de maintien des données de commande.

4. Dispositif de correction de gamma selon les revendications 1 ou 3, caractérisé en ce que ledit moyen de classification (35; 42; 105; 109) comprend une multitude de circuits de comparaison (10 à 13) qui sont disposés de manière à comparer le niveau dudit signal vidéo d'entrée à une multitude de niveaux de signaux de référence (Vr1 à Vr4).

5. Dispositif de correction de gamma selon les revendications 1 ou 3, caractérisé en ce que ledit moyen de calcul (36; 43) comprend une multitude de compteurs de déclenchement de niveau (14 à 17).

6. Dispositif de correction de gamma selon la revendication 1, caractérisé en outre par un moyen de détection (106 ; 110) afin de détecter la valeur moyenne ou la valeur intégrée dudit signal vidéo à l'intérieur de chacune de ladite multitude de gammes de niveau (a1 à a4) obtenues par ledit moyen de classification (35; 42; 105; 109), où ledit moyen de commande (37; 44; 107; 111) commande ladite caractéristique de correction de gamma en fonction de la valeur moyenne ou de la valeur intégrée dudit signal vidéo d'entrée détectée par ledit moyen de détection pour chacune de ladite multitude de gammes de niveau.

7. Dispositif de correction de gamma selon les revendications 1, 3 ou 6, caractérisé en ce que ledit moyen de commande (37; 44; 107; 111) est agencé de manière à faire une commande séparément de chacun des autres gains des signaux de ladite multitude de gammes de niveau (a1 à a4).

8. Dispositif de correction de gamma selon la revendication 6, caractérisé en outre par un moyen de maintien de données de commande (68 à 71) agencé de manière à sortir une caractéristique de correction du gain qui correspond à la valeur moyenne ou à la valeur intégrée détectée par ledit moyen de détection (106; 110) et correspondant à ladite distribution de la luminance dudit signal vidéo d'entrée, ledit moyen de commande (37; 44; 107; 111) commandant un moyen commandant ladite caractéristique de gamma en fonction de ladite caractéristique de correction du gain sortie dudit moyen de maintien des données de commande.

9. Dispositif de correction de gamma selon les revendications 1, 3, 6 ou 8, caractérisé en ce que ledit moyen de correction de gamma (34; 41; 104; 108) comprend un circuit de commande de gain (2; 52) agencé de manière à exécuter la commande du gain d'une manière prédéterminée sur ledit signal vidéo d'entrée et une multitude de circuits de commande d'atténuation (3 à 5; 53 à 55) disposés de manière à exécuter une commande de l'atténuation selon une manière prédéterminée, respectivement, sur une sortie dudit circuit de commande du gain.

10. Dispositif de correction de gamma selon les revendications 3 ou 8, caractérisé en ce que ledit moyen de maintien des données de commande

(18 à 21; 68 à 71) comporte une multitude de moyens de mémoire pour maintenir les données de correction pour ladite multitude de gammes de niveau (a1 à A4), respectivement.

11. Dispositif de correction de gamma selon les revendications 6 ou 8, caractérisé en ce que ledit moyen de classification (35; 42; 105; 109) comprend des circuits d'écrêtage et de découpage (60 à 63) agencés pour écrêter et découper ledit signal vidéo d'entrée avec des gammes correspondant à une multitude des niveaux des signaux de référence (Vr1 à Vr3).

12. Dispositif de correction de gamma selon la revendication 4, 8 ou 11, caractérisé en ce que ledit moyen de classification (35; 42; 105; 109) comprend un moyen générateur de signal de référence ayant une multitude de sources d'alimentation (6 à 9; 56 à 58) disposées en série les unes avec les autres.

13. Dispositif de correction de gamma selon la revendication 6 ou 8, caractérisé en ce que ledit moyen de détection (106; 110) comprend une multitude de moyens de filtre (64 à 67).

14. Dispositif de correction de gamma selon la revendication 6 ou 8, caractérisé en ce que ledit moyen de détection (106; 110) comprend une multitude de circuits d'intégration.

15. Dispositif de correction de gamma selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit signal vidéo est fourni par un détecteur d'image (1; 51).

16. Dispositif de correction de gamma selon l'une quelconque des revendications précédentes, caractérisé en ce que ladite correction de gamma est exécutée sur un signal vidéo numérisé.

17. Dispositif de correction de gamma selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit signal vidéo d'entrée est un signal numérique.

18. Dispositif de correction de gamma selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit signal vidéo fourni audit moyen de classification est un signal numérique.

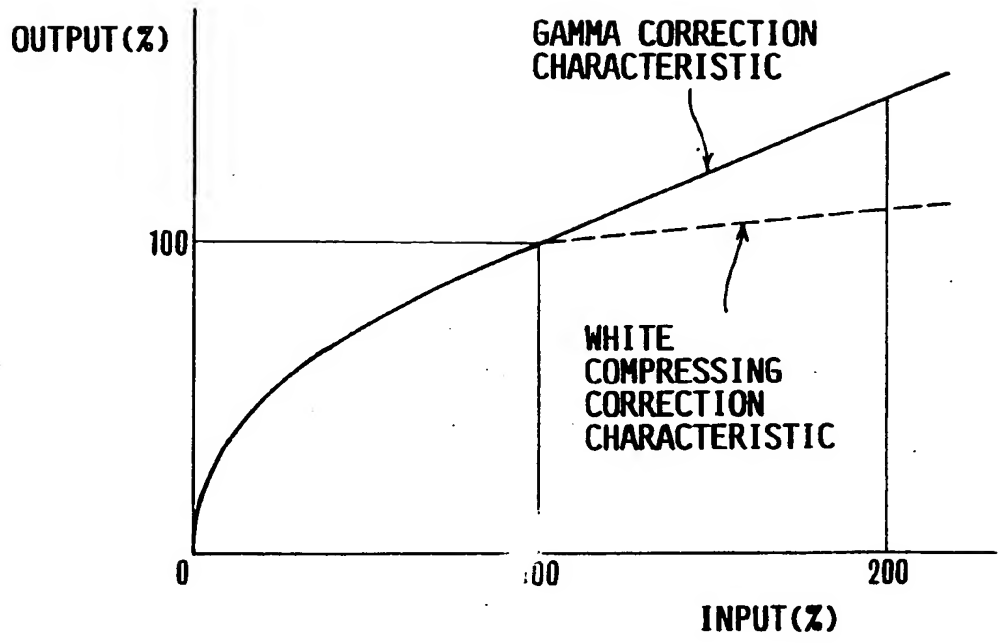
OUTPUT(%)
GAMMA CORRECTION CHARACTERISTIC
100
WHITE COMPRESSING CORRECTION CHARACTERISTIC
0
200
INPUT(%)

FIG.1

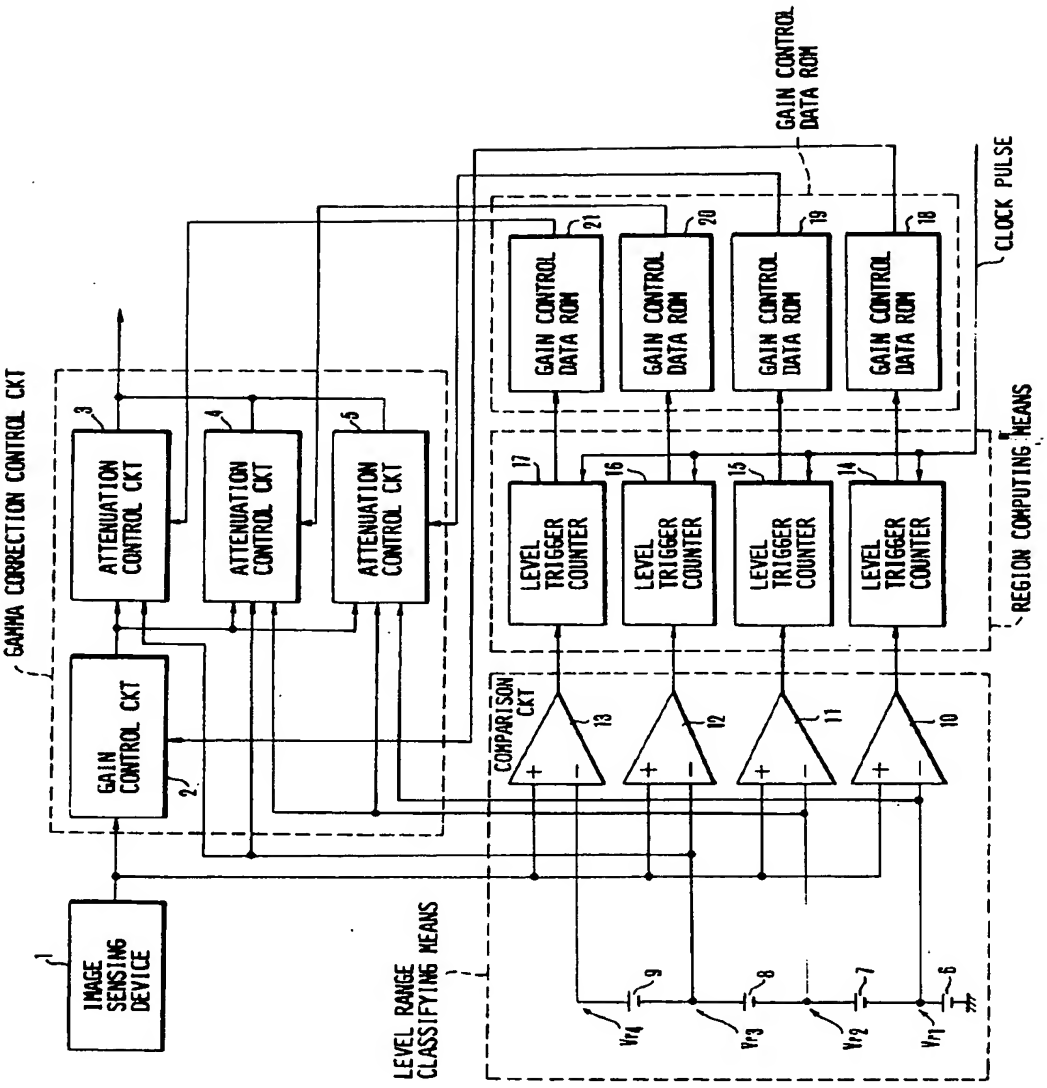
GAMMA CORRECTION CONTROL CKT
IMAGE SENSING DEVICE
GAIN CONTROL CKT
ATTENUATION CONTROL CKT
ATTENUATION CONTROL CKT
ATTENUATION CONTROL CKT
LEVEL RANGE CLASSIFYING MEANS
COMPARISON CKT
LEVEL TRIGGER COUNTER
LEVEL TRIGGER COUNTER
LEVEL TRIGGER COUNTER
LEVEL TRIGGER COUNTER
REGION COMPUTING MEANS
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
CLOCK PULSE

FIG.2

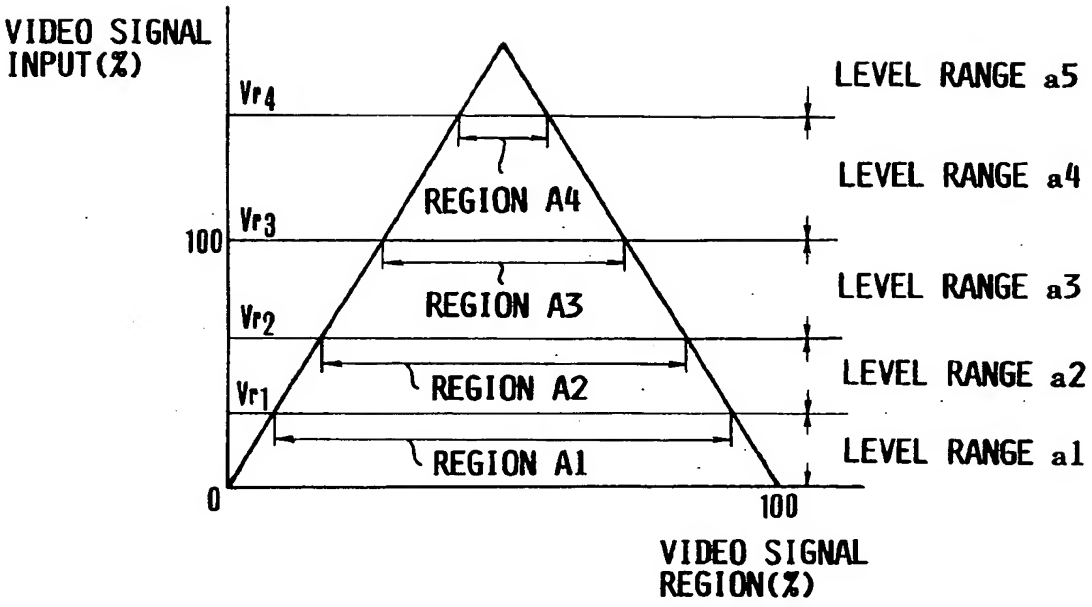
VIDEO SIGNAL INPUT(%)
Vr4
Vr3
Vr2
Vr1
100
0
REGION A4
REGION A3
REGION A2
REGION A1
LEVEL RANGE a5
LEVEL RANGE a4
LEVEL RANGE a3
LEVEL RANGE a2
LEVEL RANGE a1
100
VIDEO SIGNAL REGION(%)

FIG.3

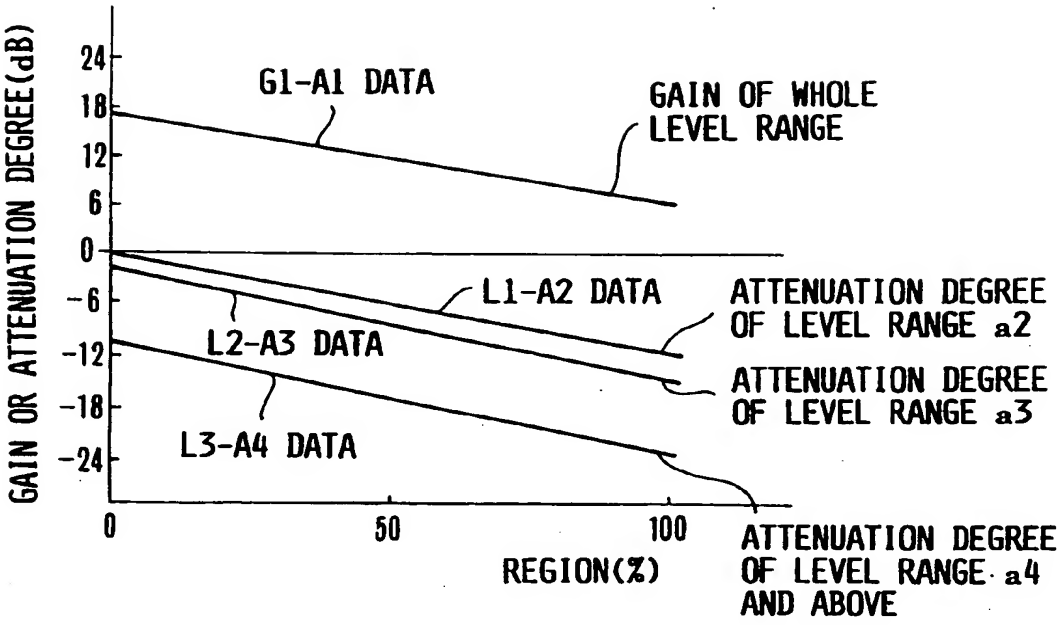
GAIN OR ATTENUATION DEGREE(dB)
24
18
12
6
0
-6
-12
-18
-24
0
50
100
REGION(%)
G1-A1 DATA
GAIN OF WHOLE LEVEL RANGE
L1-A2 DATA
ATTENUATION DEGREE OF LEVEL RANGE a2
L2-A3 DATA
ATTENUATION DEGREE OF LEVEL RANGE a3
L3-A4 DATA
ATTENUATION DEGREE OF LEVEL RANGE a4 AND ABOVE

FIG.4

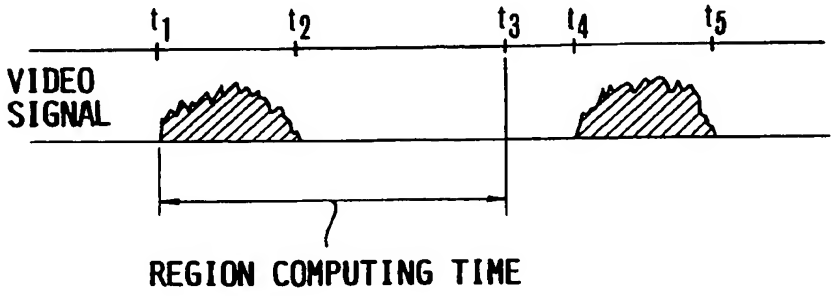
t1
t2
t3
t4
t5
VIDEO SIGNAL
REGION COMPUTING TIME

FIG.5

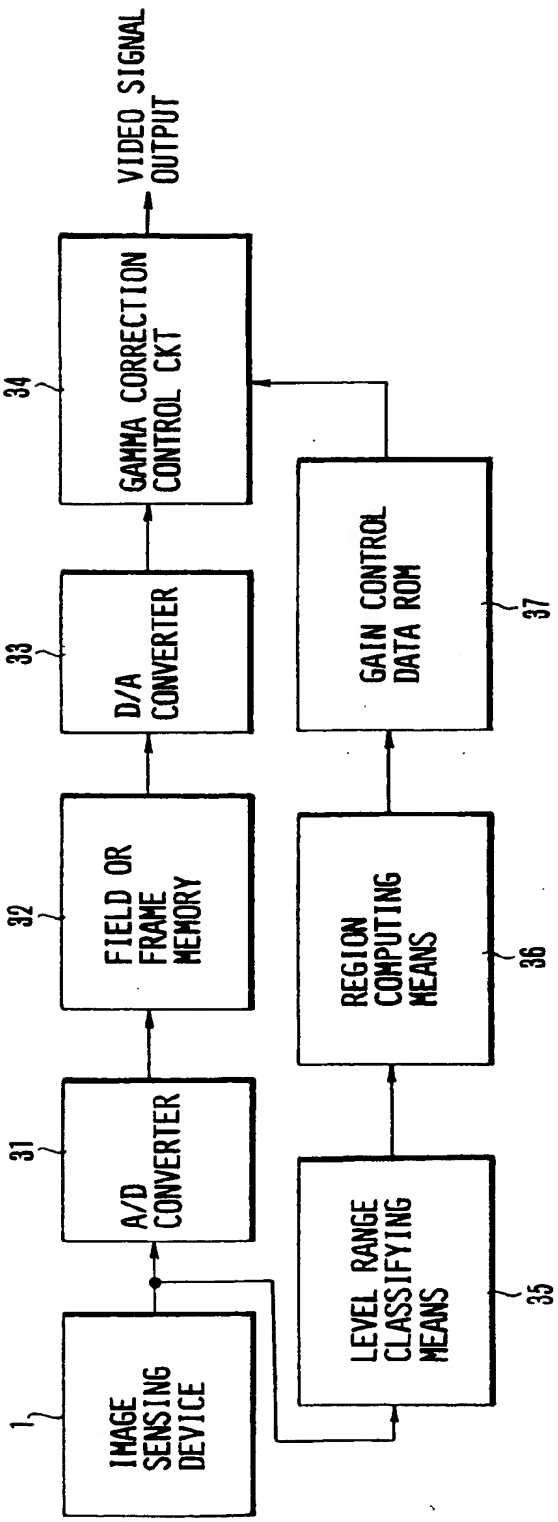
IMAGE SENSING DEVICE
1
A/D CONVERTER
31
FIELD OR FRAME MEMORY
32
D/A CONVERTER
33
GAMMA CORRECTION CONTROL CKT
34
VIDEO SIGNAL OUTPUT
LEVEL RANGE CLASSIFYING MEANS
35
REGION COMPUTING MEANS
36
GAIN CONTROL DATA ROM
37

FIG.6

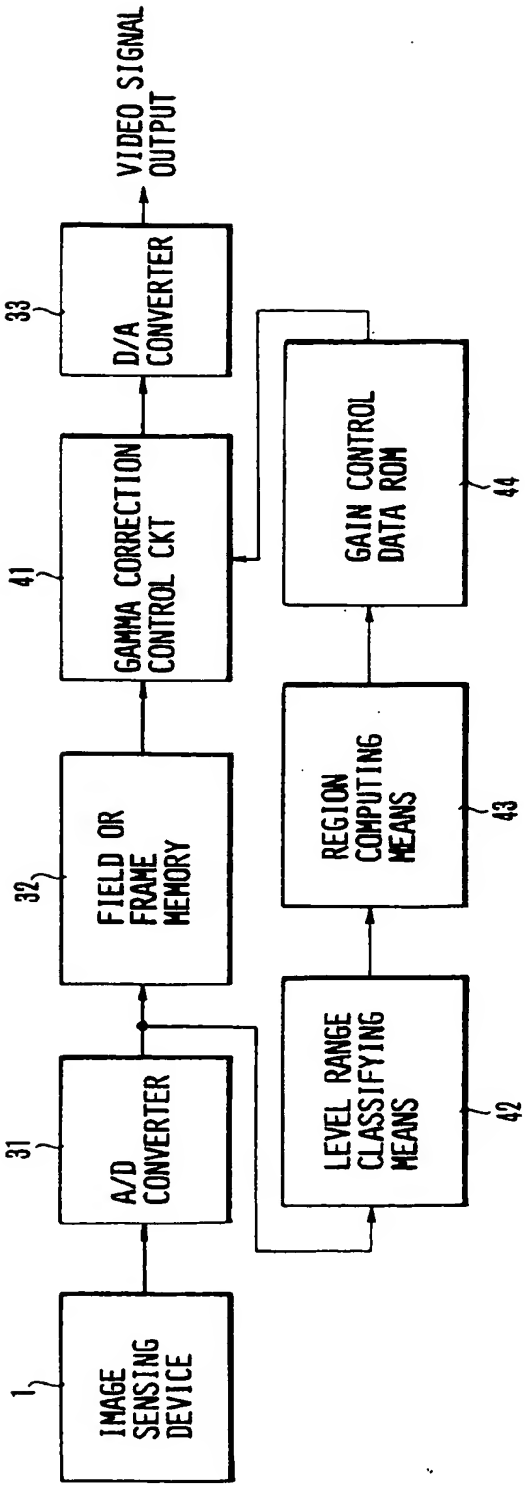
IMAGE SENSING DEVICE
1
A/D CONVERTER
31
FIELD OR FRAME MEMORY
32
GAMMA CORRECTION CONTROL CKT
41
D/A CONVERTER
33
VIDEO SIGNAL OUTPUT
LEVEL RANGE CLASSIFYING MEANS
42
REGION COMPUTING MEANS
43
GAIN CONTROL DATA ROM
44

FIG.7

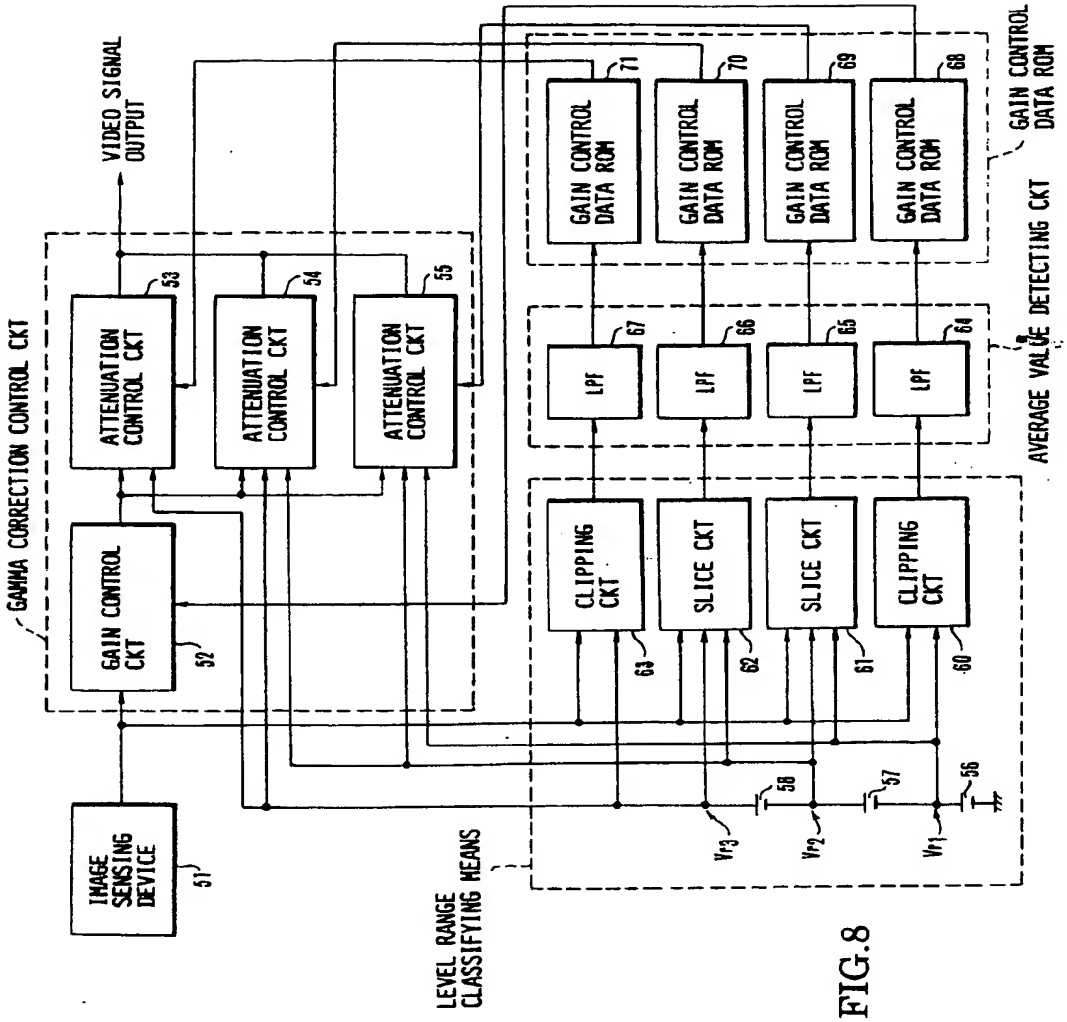
VIDEO SIGNAL OUTPUT
GAMMA CORRECTION CONTROL CKT
ATTENUATION CONTROL CKT
ATTENUATION CONTROL CKT
ATTENUATION CONTROL CKT
GAIN CONTROL CKT
IMAGE SENSING DEVICE
LEVEL RANGE CLASSIFYING MEANS
CLIPPING CKT
SLICE CKT
SLICE CKT
CLIPPING CKT
LPF
LPF
LPF
LPF
AVERAGE VALUE DETECTING CKT
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
GAIN CONTROL DATA ROM
51
52
53
54
55
56
57
58
60
61
62
63
64
65
66
67
68
69
70
71
V_{R3}
V_{R2}
V_{R1}

FIG.8

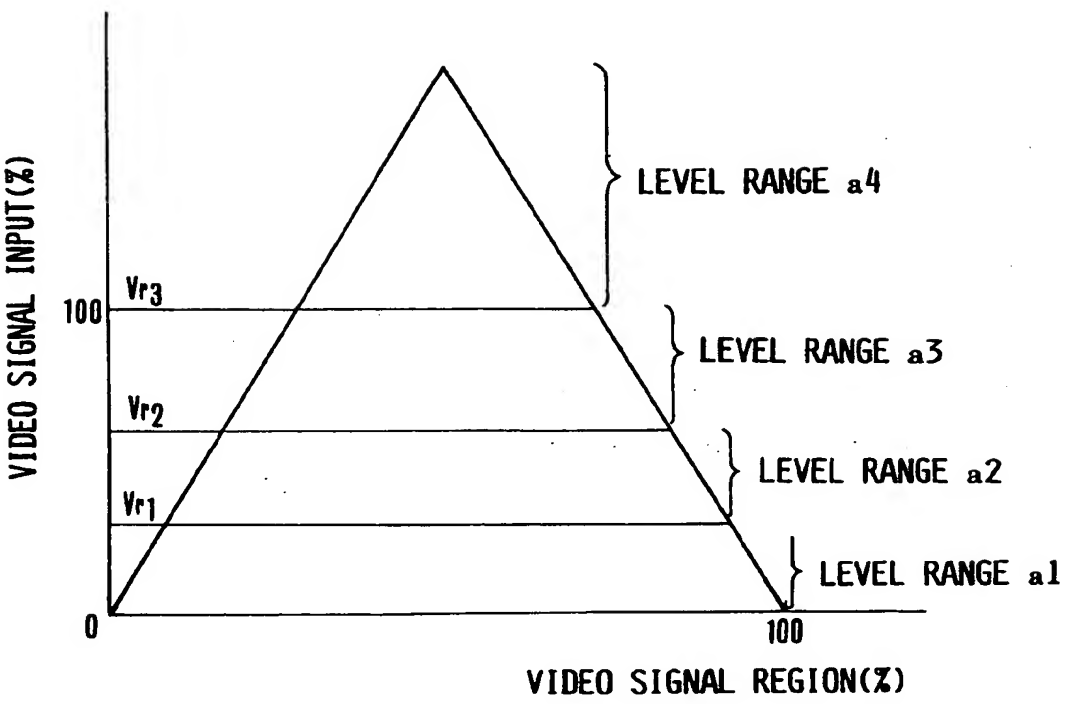
VIDEO SIGNAL INPUT(%)
100
0
Vr3
Vr2
Vr1
LEVEL RANGE a4
LEVEL RANGE a3
LEVEL RANGE a2
LEVEL RANGE a1
100
VIDEO SIGNAL REGION(%)

FIG.9

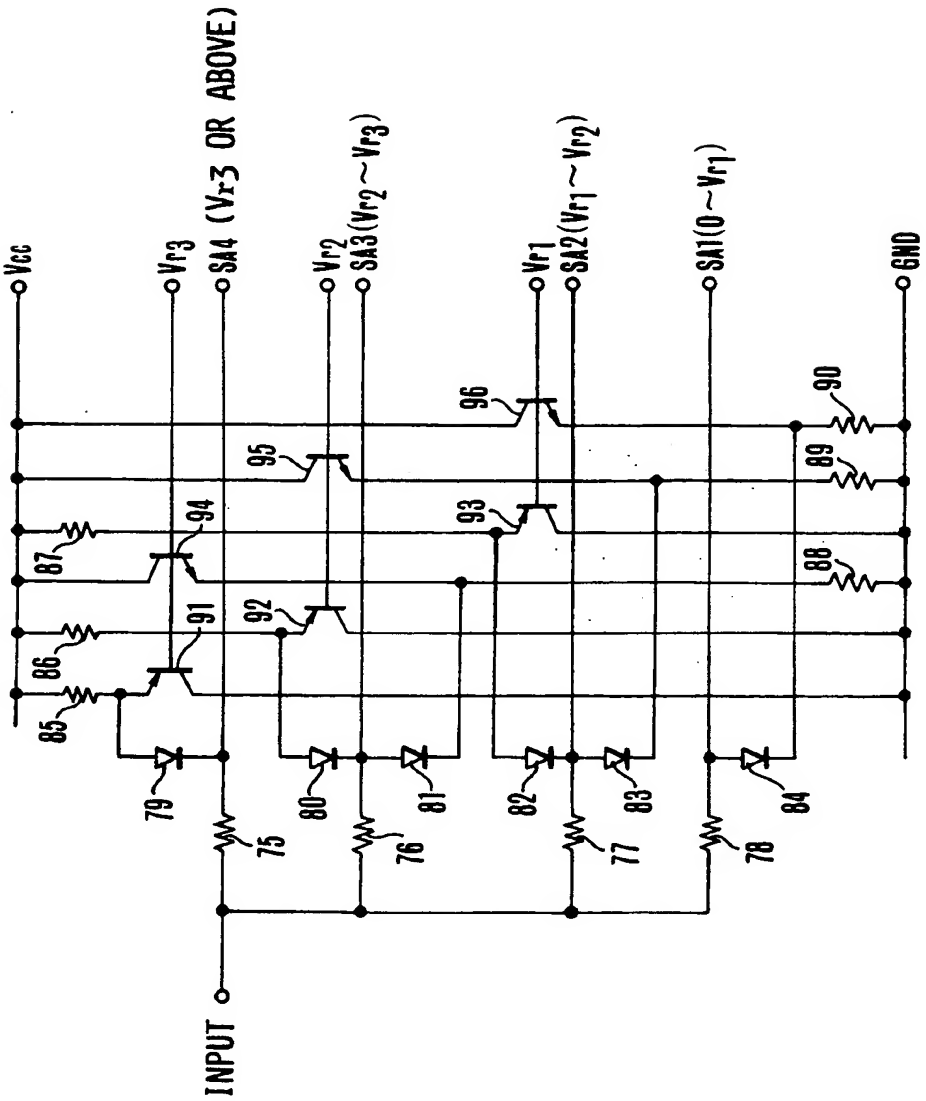
Vcc
Vr3
SA4 (Vr3 OR ABOVE)
Vr2
SA3(Vr2~Vr3)
Vr1
SA2(Vr1~Vr2)
SA1(0~Vr1)
GND
INPUT
79
80
81
82
83
84
75
76
77
78
85
86
87
91
92
94
95
96
93
90
89
88

FIG.10

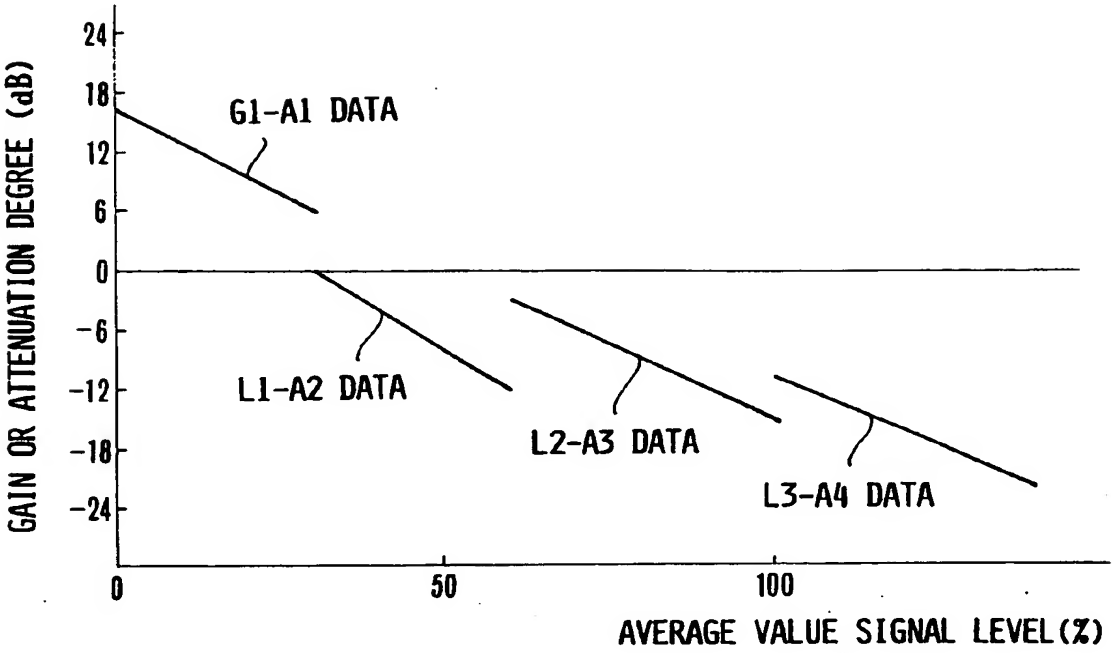
GAIN OR ATTENUATION DEGREE (dB)
24
18
12
6
0
-6
-12
-18
-24
G1-A1 DATA
L1-A2 DATA
L2-A3 DATA
L3-A4 DATA
0
50
100
AVERAGE VALUE SIGNAL LEVEL(%)

FIG.11

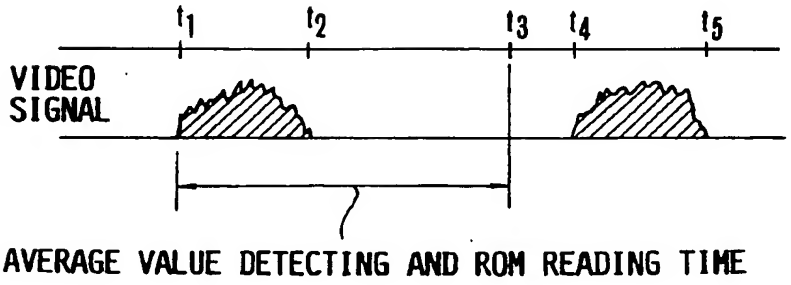
t1
t2
t3
t4
t5
VIDEO SIGNAL
AVERAGE VALUE DETECTING AND ROM READING TIME

FIG.12

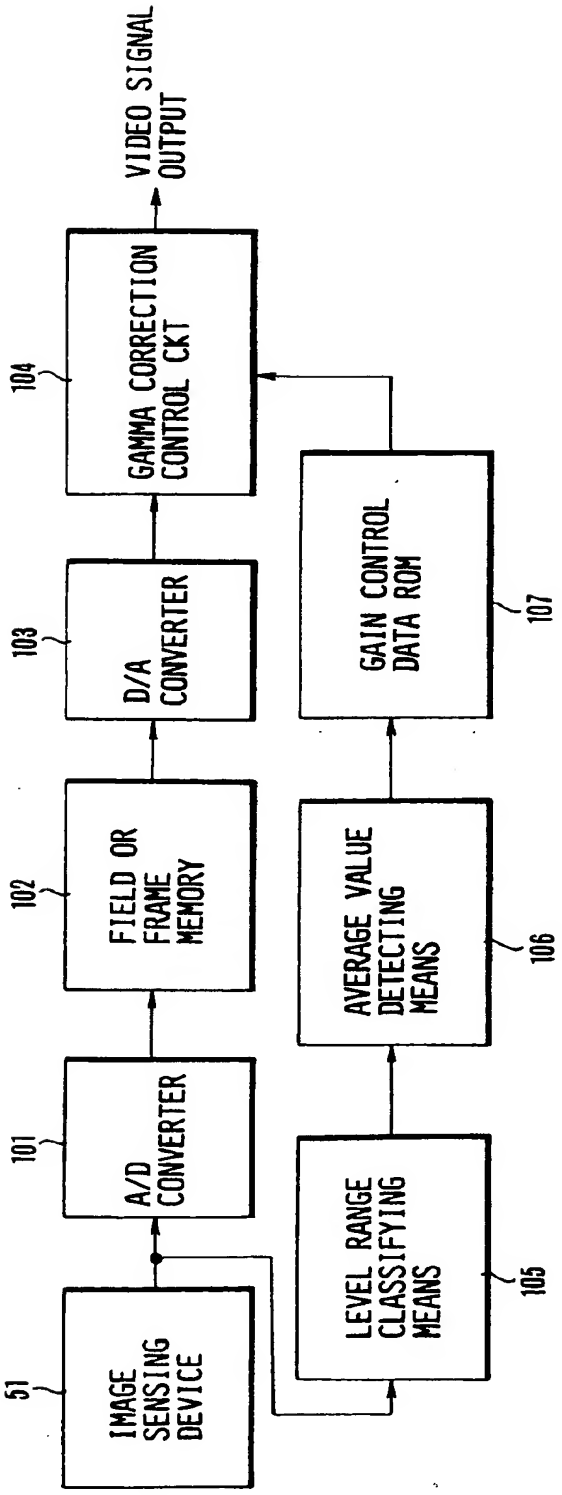
VIDEO SIGNAL OUTPUT
104
GAMMA CORRECTION CONTROL CKT
103
D/A CONVERTER
102
FIELD OR FRAME MEMORY
101
A/D CONVERTER
51
IMAGE SENSING DEVICE
107
GAIN CONTROL DATA ROM
106
AVERAGE VALUE DETECTING MEANS
105
LEVEL RANGE CLASSIFYING MEANS

FIG.13

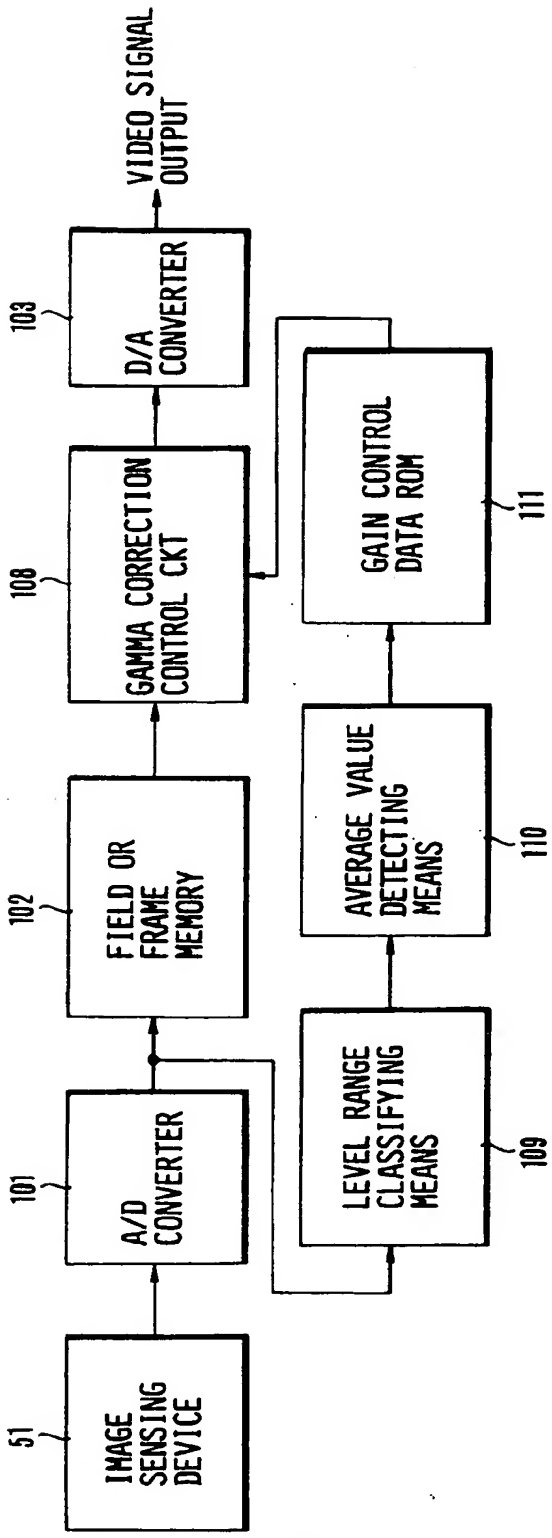
IMAGE SENSING DEVICE
51
A/D CONVERTER
101
FIELD OR FRAME MEMORY
102
GAMMA CORRECTION CONTROL CKT
108
D/A CONVERTER
103
VIDEO SIGNAL OUTPUT
LEVEL RANGE CLASSIFYING MEANS
109
AVERAGE VALUE DETECTING MEANS
110
GAIN CONTROL DATA ROM
111

FIG.14